SECTION 02200 – EARTHWORK

PART 1 – GENERAL

1.01 DEFINITION:

A. Earthwork is defined as all excavation, trenching, fill, backfill, site preparation, subgrade preparation and other appurtenant work.

1.02 CLASSIFICATION:

A. Excavation will be unclassified, and the term "excavation" shall include all material encountered without regard to its physical properties, characteristics or composition.

1.03 LIMITS OF THE WORK:

A. Earthwork shall not extend beyond the areas of excavation, embankment or other construction shown on the drawings.

B. Excavations for new construction shall not undercut existing footings, foundations, or surfacing.

C. Blasting will not be permitted.

1.04 SAFETY AND PROTECTION:

A. Shoring, sheeting, and bracing shall be provided as required to protect the work and workmen from damage or injury by caving or sloughing.

B. Laws and ordinances regulating health and safety measures shall be strictly observed.

1.05 WORK INCLUDED:

A. Provide all operations necessary to complete clearing, grubbing, topsoil removal, excavation, embankment, preparation of subgrade, crushed aggregate surfacing, riprap, structural excavation, backfilling, sloping and finish grading. Work also includes removal of water and disposal of excess material, vegetation and rubbish.

B. Construct and maintain all temporary drainage swales, berms and diversions; furnish, operate, and maintain all necessary pumping and other equipment for dewatering. After above items serve their purpose, remove them and restore site.

1.06 REFERENCES:

A. Kansas Department of Transportation (KDOT), Standard Specifications for State Road and Bridge Construction – latest issue.

B. American Society for Testing and Materials (ASTM);

1.	D 698	Moisture-Density Relations of Soils using 5.5 lb. Rammer and a 12-inch Drop.
2.	D 2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.07 SUBMITTALS:

A. Material Gradations.

B. Soil Classifications for Site and Borrow Materials.

C. Standard Proctor Curves for Site and Borrow Materials.

PART 2 – PRODUCTS

2.01 EXCAVATED MATERIALS:

A. Topsoil obtained by stripping and suitable for finish grading where topsoil is required shall be stockpiled for future use.

B. Excavated material suitable for embankment, fill or backfill, shall be placed in areas receiving embankment or stored for future use.

C. Borrow area excavations shall be limited to a maximum net depth of 12 inches. This would include 6 inches of strippings, 12 inches of removed material and the replacement of the strippings.

2.02 NATIVE MATERIAL FOR BACKFILL AND EMBANKMENT:

A. Native material used for backfill and embankments shall be free from organic matter, roots, debris, and particles larger than 3 inches in greatest dimension.

2.03 IMPERMEABLE MATERIAL FOR BACKFILL AND EMBANKMENTS:

A. Impermeable material for backfill and embankments shall be materials classified as CL, CH, or MH as defined by the Unified Soil Classification System. This material shall be free of organic matter, roots, debris, and particles larger than 1 inch in greatest dimension. Submit documentation that material meets this criteria.

2.04 CRUSHED ROCK BEDDING:

A. Aggregate for pipe bedding and granular bases shall be in conformance to the requirements of Section 1115, Kansas Department of Transportation Standard Specifications.

2.06 STONE RIPRAP:

A. Stone for erosion protection shall be in conformance to the requirements of Section 1116, Light 18" Class (or 12" D_{50}) as specified on the plans, Kansas Department of Transportation Standard Specifications.

PART 3 – EXECUTION

3.01 CLEARING AND GRUBBING:

A. Remove and dispose of trees, snags, stumps, shrubs, brush, limbs, heavy grass and other vegetal matter. All stumps, trunks, roots or root systems greater than 2-inches in

diameter shall be removed to a depth of 12-inches below finish grade or subgrade elevations.

3.02 TOPSOIL:

A. Excavate topsoil from subgrade areas. Topsoil shall be stockpiled for use in finishing operations. In general, topsoil shall be removed to a depth of one foot. The depth of topsoil may vary throughout the project. Topsoil shall be spread evenly to a depth of at least 6-inches over all cut and fill areas not covered by structures, gravel surfacing, or riprap.

3.03 OPEN EXCAVATIONS AND STOCKPILES:

A. Control excavation to prevent water from running in. Do not obstruct surface drainage or existing waterways with stockpiles.

3.04 DEWATERING:

A. Provide and maintain devices at all times during construction to remove and dispose of all water from any source from all excavations. Use methods which will ensure dry excavations and preserve the final lines and grades of the excavation. Methods used may include well points, sump pumps, suitable rock or gravel drains, temporary pipelines, or other acceptable means.

B. Commence dewatering when water is first encountered and continue until construction is complete. Dewater so that floor or footing concrete will not be placed in water. Do not allow water to rise against walls or above footings and slabs.

3.05 EXCAVATION:

A. General: Perform all material conditioning and excavations required. Excavation includes the removal and selected disposal of all excess or unsuitable materials of whatever nature.

B. Sections and Slopes: Excavate to full depth and width required to accommodate the lines and grades shown on the Drawings. Remove all materials which become blown or washed into excavations at no extra cost to the Owner.

D. Placement of Materials: Excavated material which meets required specifications may be used in embankments or backfill when approved and accepted.

E. Disposal of unsuitable and excess material. Unsuitable materials are defined as large rocks, excessive organic materials, and excess excavation material. See Articles 3.14 and 3.15 for disposal of unsuitable and excess material.

3.06 EMBANKMENTS:

A. General: Place all embankments to lines and grades shown. Areas to be covered with topsoil shall be underfilled so the finished lines conform after topsoil placement. Protect and maintain embankments during the course of construction. Replace all materials lost due to storm damage. Use materials obtained during excavation or borrow materials. Do not use brush, sod, or other unsuitable materials in embankments.

All sod and vegetable matter shall be removed from the surface upon which an embankment is to be placed and the cleared surface shall be completely broken up by plowing, scarifying or stepping to a minimum depth of 6-inches.

When an embankment is to be placed against an existing embankment whose slopes are steeper than 4:1, the existing slope shall be continuously benched and the new embankment constructed in uniform lifts. Benching shall be of sufficient width to permit operations of placing and compacting equipment. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Material thus cut out shall be recompacted along with the new embankment material.

B. No embankment shall be constructed on frozen material, nor shall organic material be used for embankment.

C. Placement: Place material in loose lifts not exceeding 9 inches, brought to within -2% to +2% of optimum moisture content. Bring up each lift uniformly over the entire area being filled. Compact each layer to 95% of maximum dry density as determined by ASTM D698 as it is placed.

D. Make provisions for proper drainage during construction on the surface by sloping at approximately 2%. Maintain during the entire construction procedure. Maintain the proper moisture content in the uppermost layer. If placing of materials is interrupted and the material dries, bring to proper moisture content before resuming by sprinkling, cultivating, and rolling to the required compaction. Do not place or roll material during rainfall of sufficient intensity to materially increase the moisture content. If any material placed in embankment acquires a greater moisture content than is suitable for compaction, allow to dry or remove. If removed, recondition the new surface before placing new material. Repair any irregularities caused by erosion by excavating, cultivating, filling, and compacting.

3.07 STRUCTURAL EARTHWORK:

A. General: Structural excavation is the removal of all materials of whatever nature to approved structural subgrade and as necessary for construction of structures and foundations. Approved structural subgrade is that material which has been observed by the Engineer and upon which structural foundations or other materials may be placed. Locate limits of excavation for structures with formed vertical surfaces at least 5 feet from the extreme outside of the structure to the toe of the cut slope. Where excavation is inadvertently carried beyond the design elevations or approved structural subgrade, adjust the construction as directed to meet the structural requirements. Rectify overdepth excavation in such locations by backfilling with crushed rock bedding material compacted to 95% maximum density or concrete as required by the Engineer. Design and install shoring if necessary. Side slopes of excavation shall be only as steep as is safe for material to stand. Avoid unnecessary disturbance of adjacent ground.

3.08 SUBGRADE FOR STRUCTURES:

A. Remove all existing loose natural clays, sand, and compressible materials under proposed structures. Excavate to depths indicated.

B. Following excavation, scarify next 8 inches of soil, moisture condition, and recompact to 95% of maximum density at a moisture content of -2% to +2% above the optimum moisture content.

C. Fill all voids with aggregate material. Remove any disturbed or unacceptable materials at excavated foundation levels and replace with aggregate material. Carefully make excavations to avoid ponding of water.

D. Exercise careful excavation procedures to provide a relatively smooth subgrade.

3.09 BACKFILL AROUND STRUCTURES:

A. Use native materials for backfill material around structures as indicated on drawings. Place backfill in 9 inch loose lifts and compact to 95% of maximum density at a moisture content within -2% to +2% of optimum in accordance with ASTM D 698.

B. Do not use any axle-driven or tractor-drawn compaction equipment within five (5) feet of any structure.

3.10 BACKFILL AROUND PIPE:

A. Following excavation of the pipe trench, crushed rock bedding material may be used to establish the proper pipe grades and to insure continuous support of the pipe. Crushed rock bedding shall not exceed 4 inches in depth.

B. Following bedding, place native material simultaneously on both sides of the pipe, keeping the level of backfill the same on each side. Carefully place the material around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe. Use particular care in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling.

C. All material within 12 inches of the outer surface of the pipe shall be compacted by hand tamping only. Place all backfill in 4 inch loose lifts and compact to 95% of maximum density at a moisture content within -2% to +2% of optimum in accordance with ASTM D698.

D. Remaining backfill shall be placed and compacted in accordance with Article 3.09A.

3.11 COMPACTION:

A. Obtain compaction of backfill and embankment by mechanical means. Do not use water jetting, hydraulic fill, or flooding. Compact each layer with mechanical tampers. Do not place backfill against concrete walls until design strength of concrete has been reached.

B. Compaction testing is not required by the Contractor. If the Owner of the project, or the Owner's representative, has concerns relative to the sufficiency of earthwork moisture and compaction efforts, the Owner may arrange for compaction testing at his expense. Any deficiencies identified shall immediately be corrected by the Contractor.

3.12 SEEDBED PREPARATION:

A. All areas where topsoil has been stripped or which have been disturbed by grading or construction activities shall upon replacement of topsoil be scarified to a depth of 6 inch minimum. All areas shall be smooth and true to the lines and grades indicated on Drawings, and ready to receive seed and fertilizer, also seedbed areas shall be free of trash, debris and rocks over 3 inch size.

B. Seeding shall be completed by the Owner.

3.13 RIPRAP PLACEMENT:

A. Riprap shall be placed to full course thickness and in a manner as to avoid displacing the underlying material. Riprap shall be laid on edge with the bedding plane at right angles to the slope and with the ends and sides abutting. To minimize voids, larger spaces between stones shall be filled with spalls of suitable size and all spalls shall be rammed thoroughly in place.

3.14 DISPOSAL OF UNSUITABLE MATERIAL:

A. Material not suitable for embankment, fill or backfill may be disposed of on-site at a location determined by the Owner. Transportation of such material shall be provided by the Contractor.

3.15 DISPOSAL OF EXCESS SUITABLE MATERIAL:

A. Material in excess of requirements for embankment, fill or backfill may be disposed of on-site at locations determined by Owner. Transportation of such material shall be provided by the Contractor.

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